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COPY FOR MR. J. ALLAN ROSS



HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

STUDY OF THOROLD SYSTEM

WALTER J. FRANCIS & COMPANY

CONSULTING ENGINEERS















THOROLD SYSTEM



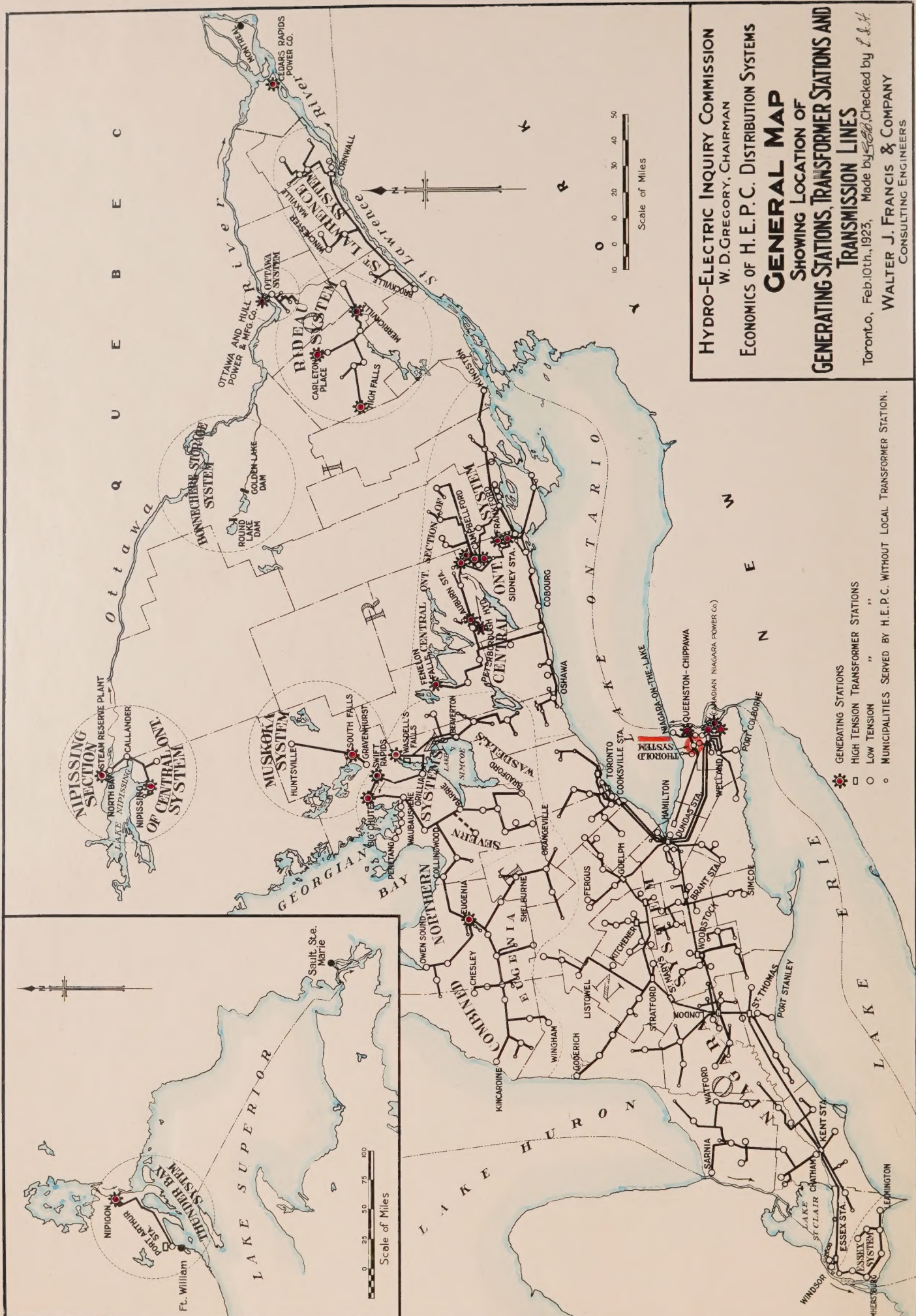


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**HYDRO-ELECTRIC INQUIRY COMMISSION**  
W.D.GREGORY, CHAIRMAN  
**ECONOMICS OF H.E.P.C. DISTRIBUTION SYSTEMS**

**GENERAL MAP**  
**SHOWING LOCATION OF**  
**GENERATING STATIONS, TRANSFORMER STATIONS AND**  
**TRANSMISSION LINES**

Toronto, Feb. 10th., 1923. Made by *E.B.B.*, checked by *L.H.H.*  
**WALTER J. FRANCIS & COMPANY**  
CONSULTING ENGINEERS

- GENERATING STATIONS
- HIGH TENSION TRANSFORMER STATIONS
- LOW TENSION
- MUNICIPALITIES SERVED BY H.E.P.C. WITHOUT LOCAL TRANSFORMER STATION.



HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

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Hydro-Electric Power Commission of Ontario.

Thorold System.

WATER J. FRANK & COMPANY  
1000 N. 1st St. N. W.  
WASHINGTON, D. C.  
20001  
Phone: 333-3333

WATER J. FRANK & COMPANY  
1000 N. 1st St. N. W.  
WASHINGTON, D. C.  
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THE SYSTEM

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100-110 Broadway  
New York

MEMORANDUM

TO :

FROM :

SUBJECT: ...  
...  
...  
...  
...

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LIST OF ILLUSTRATIONS

THOROLD SYSTEM

June 30th, 1923

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Toronto, Ontario,

June 8th, 1923.

Hydro-Electric Inquiry Commission,  
W. D. Gregory, Esq., Chairman,  
T O R O N T O, Ontario.

re Studies of Engineering Economics of the  
Thorold System of the  
Hydro-Electric Power Commission of Ontario

Mr. Chairman and Gentlemen,-

In accordance with the letter to your Commission under date of November 4th, 1922, and your confirmation of the general instructions under date of November 15th, 1922, a study has been made of the engineering economics of the Thorold System of electrical distribution operated by the Hydro-Electric Power Commission of Ontario. The work has been done under the direct personal supervision of Mr. Frederick B. Brown, M. Sc., M.E.I.C., a partner in the firm of Walter J. Francis & Company, in accordance with your instructions.

The subject has been discussed with Mr. Commissioner R. A. Ross in detail, and, generally, with Mr. Bower, the Secretary of your Commission, and constant communication has been maintained with the officials of the Hydro-Electric Power Commission of Ontario.

The reports of Messrs. Price, Waterhouse & Co. have been used as the basis of the financial figures given herein, and reference has been made to the records of the Hydro-Electric Power Commission of Ontario where it was necessary to do so to prepare the diagrams.





It is understood that it is not within the scope of the instructions to examine into any of the legal aspects of the System nor discuss any of the Acts of the Legislature relating to it.

The necessary technical data has required considerable preparation, as much of it is only available in the operating records of the Hydro-Electric Power Commission of Ontario. The printed reports contain a part, but these have had to be supplemented by interviews with various officials, and by searching the voluminous records both at the head office in Toronto and elsewhere. The map included as a frontispiece shows the System geographically and where.

The general plan under which the report of the studies is presented may be outlined as follows:

COPY

- (1) A short review of the history and evolution of the System.
- (2) A brief physical description of the System.
- (3) A brief discussion regarding the characteristics of the local market.
- (4) A discussion of progressive capital costs.
- (5) Statistics regarding progressive revenues for various classes of service, with discussion thereon.
- (6) Statistics regarding progressive operating costs and fixed charges, with discussion thereon.
- (7) Statistics showing progressive and accumulated deficits or surpluses, with discussion thereon.
- (8) Analysis of progressive operating records and of unit revenues per kilowatt-hour and per horse-power per annum, and of unit costs per kilowatt-hour and per horse-power per annum.





(9) A brief discussion of the various important points concerning the System.

The report included herewith as pages 4 to 41 inclusive refers in detail to that portion of the activities of the Hydro-Electric Power Commission known as the Thorold System. References are made to the possible inter-connection of this System with other Systems.

Throughout the report diagrams have been included in the order of the text, while the map included as a frontispiece shows the System generally and its geographical relation to all the other Systems operated by the Hydro-Electric Power Commission of Ontario.

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[illegible]

100

The above procedure is repeated for all the input data.

THESE RESULTS WERE OBTAINED BY THE FOLLOWING PROCEDURE:

Source: U.S. Census Bureau, *Statistical Abstract of the United States*, 1997.

—continued from page 10—

Throughout the report different data are provided in the form of an

1992, while we are looking at a perspective about the future generally and

It is suggested that the following steps be taken to improve the quality of the data:

Y405



if he so desired, to have the THOROLD SYSTEM of distribution of

the Ontario Power Company might have been secured to him.

Frederick B. Brown, M. Sc.

specified territory, Mr. Battle agreeing to pay the total cost of the negotiations leading up to the signing of any contract.

Evolution and Development of the System.

On October 24th, 1910, James Battle of the Town of Thorold in Welland

County entered into an agreement with the Ontario Power Company for the purchase of power for distribution in certain territory in the vicinity of Thorold.

The agreement specifies the rates to be paid for power and recognizes the sole right of James Battle to supply power to any industry in the territory specified. The agreement extends for a period of thirty years from May 1st, 1911.

On April 29th, 1912, a supplementary agreement was made which increased the territory which was to be supplied through the Battle transmission lines and specified certain slightly increased rates to be paid for power sold by Mr. Battle in the added territory.

The Ontario Power Company agreed that within the territory, the limits of which were defined in the contract, it would not sell power to any consumer not at that date a customer, nor to anyone to whom it was not by law compelled to sell power, provided that the demand was for less than 100 horse-power. If the power required exceeded that quantity, the Ontario Power Company was to give thirty days notice in writing to James Battle concerning the proposed contract, and all possible assistance which he might request in securing the contract for himself, Mr. Battle agreeing to pay for such assistance rendered by the Power Company. It was also agreed that Mr. Battle should have the right,

THE BANK

WALTER J. FRANK & COMPANY

Evolution and Development of the Bank

COPY



if he so desired, to take over and carry out any contract or contracts which the Ontario Power Company might thereafter secure to supply power within the specified territory, Mr. Battle agreeing to pay the total cost of the negotiations leading up to the signing of any contracts so taken over from the Power Company.

Any contracts made for the sale of power to railway companies, however, were not to be subject to these agreements.

The original and the supplementary agreements specified the following rates for various quantities of power which might be taken by James Battle.

Quantity of Power in H. P.		Rate per H.P. per Annum Original Territory	Rate per H. P. per Annum Added Territory
From	To		
100	199	\$15.00	\$15.50
200	299	14.50	15.00
300	399	14.00	14.50
400	499	13.50	14.00
500 or more according to contract		13.00	13.50

From this summary of the agreements and the prices at which James Battle could buy power from the Ontario Power Company, it can be seen that Mr. Battle's rights under these agreements were likely to become valuable as the demand for and cost of power increased.

James Battle proceeded to make contracts for the supply of power to various individuals and companies in the territory specified in his agreements, and by 1918 he was supplying the following customers:





St. Lawrence Paper Mills Co. Limited,

Wm. C. Wilson & Company.

The Dextrine Company.

J. A. Constable.

Pilkington Bros. Limited,

Thos. Critelli,

Thompson & Company.

Gardner & Company.

In 1918 the average quantity of power sold by the Ontario Power Company to James Battle amounted to about 707 horse-power. The Ontario Power Company also entered directly into contracts to supply power to the Ontario Paper Company and the Beaver Wood Fibre Company, which were located in Mr. Battle's territory. Mr. Battle did not take over the contracts to supply power to these companies, but it was mutually agreed between the Ontario Power Company and himself that royalties at the following rates should be paid to him on all power furnished by the Ontario Power Company to these two manufacturers, as follows:

<u>Company</u>	<u>Basis of Payment of Royalty to Mr. Battle or his Successor</u>	<u>Date Accepted</u>
Ontario Paper Company, Limited	50¢ per H.P. per Annum on the day-time power 10¢ per H.P. per Annum on the night-time power (upon receipt of payment of power bills by Power Company)	March 20th, 1912.
Ontario Paper Company, Limited, (Sale of temporary power)	When and as the bills for this temporary power are paid by the Paper Company, an amount equal to 1.75% of the amount so paid	January 22nd, 1914.
Beaver Wood Fibre Company, Limited, (now Beaver Board Company, Limited)	25¢ per H.P. per Annum, payment to be made upon collection of power bill from Beaver Company	January 22nd, 1914.

THE BANKERS TRUST CO. OF NEW YORK  
THE BANK OF AMERICA  
THE BANK OF CALIFORNIA  
THE BANK OF MONTREAL  
THE BANK OF NEW YORK  
THE BANK OF OREGON  
THE BANK OF THE PACIFIC  
THE BANK OF THE SOUTH  
THE BANK OF THE WEST

IN THE COURT OF THE COMMONS OF GREAT BRITAIN  
IN PARLIAMENT ASSEMBLED  
THE PETITION OF THE BANKERS TRUST CO. OF NEW YORK  
FOR AN ORDER THAT THE BANKERS TRUST CO. OF NEW YORK  
SHOULD BE RECEIVED AS A DEBENTURE HOLDER OF THE  
STOCK OF THE BANK OF AMERICA IN THE SUM OF  
ONE HUNDRED THOUSAND DOLLARS AND THAT THE BANKERS  
TRUST CO. OF NEW YORK SHOULD BE RECEIVED AS A  
DEBENTURE HOLDER OF THE STOCK OF THE BANK OF  
CALIFORNIA IN THE SUM OF ONE HUNDRED THOUSAND  
DOLLARS AND THAT THE BANKERS TRUST CO. OF NEW YORK  
SHOULD BE RECEIVED AS A DEBENTURE HOLDER OF THE  
STOCK OF THE BANK OF MONTREAL IN THE SUM OF  
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TRUST CO. OF NEW YORK SHOULD BE RECEIVED AS A  
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YORK IN THE SUM OF ONE HUNDRED THOUSAND DOLLARS  
AND THAT THE BANKERS TRUST CO. OF NEW YORK SHOULD  
BE RECEIVED AS A DEBENTURE HOLDER OF THE STOCK OF  
THE BANK OF OREGON IN THE SUM OF ONE HUNDRED  
THOUSAND DOLLARS AND THAT THE BANKERS TRUST CO. OF  
NEW YORK SHOULD BE RECEIVED AS A DEBENTURE HOLDER  
OF THE STOCK OF THE BANK OF THE PACIFIC IN THE  
SUM OF ONE HUNDRED THOUSAND DOLLARS AND THAT THE  
BANKERS TRUST CO. OF NEW YORK SHOULD BE RECEIVED  
AS A DEBENTURE HOLDER OF THE STOCK OF THE BANK OF  
THE SOUTH IN THE SUM OF ONE HUNDRED THOUSAND  
DOLLARS AND THAT THE BANKERS TRUST CO. OF NEW YORK  
SHOULD BE RECEIVED AS A DEBENTURE HOLDER OF THE  
STOCK OF THE BANK OF THE WEST IN THE SUM OF ONE  
HUNDRED THOUSAND DOLLARS

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NAME OF BANK	AMOUNT OF STOCK	DATE OF ORDER
BANKERS TRUST CO. OF NEW YORK	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF AMERICA	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF CALIFORNIA	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF MONTREAL	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF NEW YORK	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF OREGON	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF THE PACIFIC	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF THE SOUTH	ONE HUNDRED THOUSAND DOLLARS	1814
BANK OF THE WEST	ONE HUNDRED THOUSAND DOLLARS	1814



After the Hydro-Electric Power Commission had acquired the Ontario Power Company, it is stated that they came to the conclusion that it would be in the interests of the Commission, of the Municipality of Thorold, and of the other municipalities in the district for the Commission to purchase Mr. James Battle's plant, contracts and rights, the intention apparently being that all would be eventually taken over and paid for by the Municipality of Thorold at a later date.

In 1918 the engineers of the Commission made an appraisal of the System and estimated that the present worth of the royalties which would be paid on power sold to the Ontario Paper Company and the Beaver Wood Fibre Company during the twenty-three years of remaining life of the agreement amounted to about \$57,461. They placed the present value of the contracts with consumers and the sold power made available by the ownership of these contracts at about \$103,402. The value of the substation and distribution system they estimated to be about \$25,872. The total value placed on the whole system, including station and distributing line, contracts, franchises, goodwill and so forth, therefore, amounted to about \$186,735.

In a report to the Prime Minister of Ontario, dated October 2nd, 1918, embodying the above information, the Commission recommended that it be authorized to purchase Mr. James Battle's plant on behalf of the Municipality of Thorold. The agreement between the Commission and Mr. James Battle, dated October 1st, 1918, was approved by Order-in-Council on October 23rd, 1918, taking over the business as at October 17th, 1918, and the purchase was completed on December 1st, 1918, when the Commission entered into possession of





the System. By this agreement Mr. Battle transferred to the Hydro-Electric Power Commission his franchise and rights to furnish and distribute "electric light, heat, power and energy" in the Township and Town of Thorold, and his right to use and occupy highways in these municipalities for this purpose. His contracts with the consumers listed on page 5 were surrendered to and assumed by the Commission, as were also the contracts and agreements with the Ontario Power Company and its subsidiary The Ontario Transmission Company, Limited, for the supply of power to him. The complete plant, consisting of land, substation and its equipment, transmission lines, distributing system, etc., was also transferred to the Commission. The intention was in fact to transfer to the Commission the complete "Battle System" as a going concern, Mr. Battle merely reserving to himself the cash, promissory notes, bills and accounts receivable, etc., to which he was entitled on December 1st, 1918.

The price paid to Mr. Battle for these various franchises, rights, agreements and articles, comprising the plant and equipment of the System, was in bonds of the Hydro-Electric Power Commission of Ontario, guaranteed by the Province of Ontario, of the par value of \$100,000, dated December 1st, 1918, payable 40 years from the date of issue and bearing interest at the rate of 4 per cent. per annum payable half-yearly.

The Commission assumed control and took over the operation of the System on December 1st, 1918.

The additional capital expenditure on the System by the Commission since that date has been very small, amounting to only \$1,331.09 in all, which was for additions and betterments made to the substation.





On December 20th, 1920, a standard form of contract was signed between the Commission and the Town of Thorold for the supply of power to the town by the Commission "at cost".

#### Description of the System.

##### General.

The System consists of a short section of 12,000-volt transmission line from the junction with the Ontario Power Company's lines to, and including, the Thorold distributing station where the voltage is reduced to 2,300 volts, and power is sent over the distributing lines to supply the various customers of the System. In this respect it differs from most of the systems under the control of the Commission as the distributing station and local distributing system represent about 90 per cent. of the value of the tangible assets of the System, the transmission lines amounting to the remaining 10 per cent. of the value.

##### Source of Power Supply.

There is no generating plant on the Thorold System, but, as explained under the heading "Evolution and Development of the System", power is bought from the Ontario Power Company for transmission and distribution to the various customers of the System in the territory specified in the agreements between James Battle and the Ontario Power Company. The transmission lines of the Ontario Power Company must therefore be considered the immediate source of power

the contract of 1929, 1930, a standard form of contract was signed between the Government and the United States and the United States and the Government the Government "at once".

THE CONTRACT

The contract was a very simple one, it was a contract between the Government and the United States and the United States and the Government the Government "at once".

COPY

There is no repeating glass on the United States, but, as explained under the heading "Repetition and development of the system", power is supplied to the United States and the United States and the Government the Government "at once".



supply, with the generating plant of the Ontario Power Company at Niagara Falls the primary source of the power used on the System. The Town of Thorold is about eight miles from Niagara Falls and thus within easy transmission distance at the generated voltage.

The town owns a small hydro-electric plant, taking water from the old Welland Canal and using it under a twelve-foot head to drive a 220 horse-power turbine to which is belted a 120-K.W., single-phase, 60-cycle, 2,400-volt generator. This plant is old, having been installed in 1888, and is still in operation. It has been recently overhauled.

#### Transmission Line.

COPY

The transmission line of the Thorold System consists of about one mile of 12,000-volt line which runs from the junction with the Ontario Power Company's line to the Thorold System distributing station. This is a wooden pole line and presents no unusual features.

#### Transforming and Distributing Station.

The station contains transformers of about 2,000 K.V.A. total capacity, which reduce the voltage from 12,000 to 2,300 volts, and the necessary switch-board and other equipment to control the distribution of the power to the Town of Thorold and to the private consumers on the System.

#### Distributing System.

The distributing system consists of about nineteen miles of 2,300-volt

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line which carries the current to the consumers.

Both the station and the distributing system are owned and operated by the Commission which here acts as a retail distributor and seller of power. There is only one municipality on the System, namely the Town of Thorold, which now has a contract for the supply of power from the System "at cost". It is therefore a "Hydro" municipality and the details of its finances, load, etc., are shown in the Annual Reports of the Commission. The details of charges, etc., to the private consumers on the System are not shown in the Annual Reports.

## COPY

### Characteristics of Market.

#### Population Served and Percentage of Consumers to Population.

The district served by the Thorold System embraces the Town of Thorold and some consumers outside this municipality, but as far as population served is concerned this is practically limited to the population of the Town of Thorold, which was 5,514 in 1921. There are no rural lines on the system. The table on the following page gives in detail the number of consumers in Thorold at the end of the fiscal year 1921, the approximate horse-power billed in that year, together with the average horse-power billed and the average horse-power per consumer. The figures are useful for comparison with other systems, although they should be used with caution.



The first section of the report...

From the figures and the accompanying notes...

the Commission will note that a fairly high...

There is also a considerable amount of...

which are not a serious factor in the...

It is therefore a "highly" successful...

which are shown in the annual reports...

and which are not shown in the annual...

figures.

COPY

WALTER J. BARKER & COMPANY

1000 1/2 West 10th Street, New York, N. Y.

The following figures for the year...

and which are not shown in the annual...

is shown in the annual reports...

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the table in the annual report gives in detail...

figures of the year 1931, and...

in the table, figures for the year...

figures for comparison. The figures are useful...

figures of the year 1931...

## Table of Market Statistics

---

Population in 1921 .....	5,514
Consumers in 1921 .....	1,094
Percentage Consumers to Population ...	19.8
Horse-power Billed in 1921 .....	379.3
Billed Horse-power per Consumer .....	0.35

---

The average horse-power billed per capita in 1921 was 0.07.

If the power consumed by the companies and individuals supplied directly by the System be considered, these being all located in or very close to the Town of Thorold, the above figures are very largely increased and the averages are as follows:

COPY

Average of Total Horse-power Billed by the System in 1921 .....	2,083
Kilowatt-hours .....	7,123,680
Billed Horse-power per Consumer .....	1.95
Billed Horse-power per Capita .....	0.38
Kilowatt-hours per Consumer .....	6,476
Kilowatt-hours per Capita .....	1,290

Growth of Market.

Since the Hydro-Electric Power Commission took over the Thorold System in 1918, the power consumed has varied greatly. There was a rapid increase from 950 horse-power in 1919 to 2,083 horse-power in 1921, followed by a decrease to about 1,650 horse-power in 1922. The records are not complete, but this decrease is largely due to the change in the contracts for the Welland Ship Canal, Sections 3 and 4. The variation is to a considerable extent caused by the progress of the work on the construction of the canal. The firm of Doheny, Quinlan & Robertson, one of the former contractors, took an average of

Table 1. Wages and Salaries in Commerce

1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612	1611	1610	1609	1608	1607	1606	1605	1604	1603	1602	1601	1600	1599	1598	1597	1596	1595	1594	1593	1592	1591	1590	1589	1588	1587	1586	1585	1584	1583	1582	1581	1580	1579	1578	1577	1576	1575	1574	1573	1572	1571	1570	1569	1568	1567	1566	1565	1564	1563	1562	1561	1560	1559	1558	1557	1556	1555	1554	1553	1552	1551	1550	1549	1548	1547	1546	1545	1544	1543	1542	1541	1540	1539	1538	1537	1536	1535	1534	1533	1532	1531	1530	1529	1528	1527	1526	1525	1524	1523	1522	1521	1520	1519	1518	1517	1516	1515	1514	1513	1512	1511	1510	1509	1508	1507	1506	1505	1504	1503	1502	1501	1500	1499	1498	1497	1496	1495	1494	1493	1492	1491	1490	1489	1488	1487	1486	1485	1484	1483	1482	1481	1480	1479	1478	1477	1476	1475	1474	1473	1472	1471	1470	1469	1468	1467	1466	1465	1464	1463	1462	1461	1460	1459	1458	1457	1456	1455	1454	1453	1452	1451	1450	1449	1448	1447	1446	1445	1444	1443	1442	1441	1440	1439	1438	1437	1436	1435	1434	1433	1432	1431	1430	1429	1428	1427	1426	1425	1424	1423	1422	1421	1420	1419	1418	1417	1416	1415	1414	1413	1412	1411	1410	1409	1408	1407	1406	1405	1404	1403	1402	1401	1400	1399	1398	1397	1396	1395	1394	1393	1392	1391	1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	1377	1376	1375	1374	1373	1372	1371	1370	1369	1368	1367	1366	1365	1364	1363	1362	1361	1360	1359	1358	1357	1356	1355	1354	1353	1352	1351	1350	1349	1348	1347	1346	1345	1344	1343	1342	1341	1340	1339	1338	1337	1336	1335	1334	1333	1332	1331	1330	1329	1328	1327	1326	1325	1324	1323	1322	1321	1320	1319	1318	1317	1316	1315	1314	1313	1312	1311	1310	1309	1308	1307	1306	1305	1304	1303	1302	1301	1300	1299	1298	1297	1296	1295	1294	1293	1292	1291	1290	1289	1288	1287	1286	1285	1284	1283	1282	1281	1280	1279	1278	1277	1276	1275	1274	1273	1272	1271	1270	1269	1268	1267	1266	1265	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951	950	949	948	947	946	945	944	943	942	941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about 1,700 horse-power in 1921, and contributed about 77 per cent. of the total revenue for that year, while in 1922 they took about 970 horse-power and contributed about 58 per cent. of the revenue of the System. P. Lyall & Sons Construction Company, Limited, took over this work in 1922 and made a new power contract, the demand being only a few hundred horse-power during the balance of 1922. In 1923 it will probably be 1,800 horse-power or thereabouts. The sale of power on this construction work can of course be considered as only temporary, and will last only a few years longer. Neglecting this temporary increase in the load on the System due to the construction of the Welland Ship Canal, the growth of the load has been small, and, with the records available, impossible to determine with any degree of accuracy.

#### Capital Costs.

#### General.

The table on page 15 and the sheet of curves on page 16 show the progressive capital costs. These have been prepared from information contained in the report of Messrs. Price, Waterhouse & Co. on the Thorold System, dated November 29th, 1922. The total capital cost equivalent to the total value of capital assets, has been taken directly from Exhibit I of that report. The division of the total capital costs as between transformer and distributing station, distributing system, and intangibles is approximate. The cost of intangibles has been taken as the purchase price, \$100,000, less a valuation of about \$25,872 placed on the real property by the engineers in 1918. This gave intangibles a value





of about \$74,128, and this has been taken as their constant value in all years.

The intangible capital costs in part represent the amount paid Mr. James Battle for the present worth of the royalties to be paid by the Ontario Power Company for power which would be sold to the Ontario Paper Company and the Beaver Wood Fibre Company during the remaining life of its contract with Mr. Battle, which would have expired on May 1st, 1941. The engineers, as previously mentioned, placed the present worth of these royalties at about \$57,461 at the date of acquisition. The intangible capital costs also represent the amount paid for Mr. Battle's franchise to distribute power and his contract for power to be supplied by the Ontario Power Company at the rates specified on page 5, and the contracts for the sale of this power to the various customers listed on page 6. The engineers valued these contracts and the power which would become available through control of them at about \$103,402. The total value which they placed on intangibles thus amounted to \$160,863, whereas the amount which was actually paid for intangibles in the purchase price was about \$74,128.

The appraisal value of the station and distributing system at the date of acquisition by the Commission was \$25,872. A "replacement" valuation, however, was made for the purpose of determining the percentage rate for the renewals reserve, and the details of this are given in the report of Messrs. Price, Waterhouse & Co., where the replacement value of station and distributing system as acquired is stated to have been about \$31,740, the station amounting to about \$25,155 and the distributing system to about \$6,585. The amount, \$25,872, allowed in the purchase price for station and distributing system has been divided in the proportion of these figures, making the approximate





cost of the station \$20,272, and of the distributing system \$5,600. These are the figures given in the table for December 1st, 1918. It is to be noted that the total transmission line on the System, about one mile in length, is included with the distributing systems as the figures available did not differentiate the capital cost of this transmission line from the distributing lines of the System. It is stated that all additional capital expenditure was made on account of the station; the increase has therefore been made to this item, and the cost of the distributing system allowed to remain constant from December 1st, 1918, to October 31st, 1921.

The progressive capital costs are as follows:

Table of Progressive Capital Costs

Capital Assets	December	Fiscal Year Ending October 31st,		
	1st 1918	1919	1920	1921
Transformer and Distributing Station	\$20,272	\$20,654	\$21,045	\$21,603
Distributing System	5,600	5,600	5,600	5,600
Intangibles	74,128	74,128	74,128	74,128
Totals	\$100,000	\$100,382	\$100,773	\$101,331

Power Data.

The following table and the sheet of curves included as page 18 have been prepared to show the characteristics of the Thorold System in terms of horsepower. The figures are as follows:

PROGRESSIVE CAPITAL COSTS

and of the United States, all the information which is required for the purpose of the present report is contained in the following table. The table is divided into two parts, the first of which contains the data for the year 1911, and the second contains the data for the year 1912. The data for the year 1911 is given in the first column, and the data for the year 1912 is given in the second column. The data for the year 1911 is given in the first column, and the data for the year 1912 is given in the second column. The data for the year 1911 is given in the first column, and the data for the year 1912 is given in the second column.

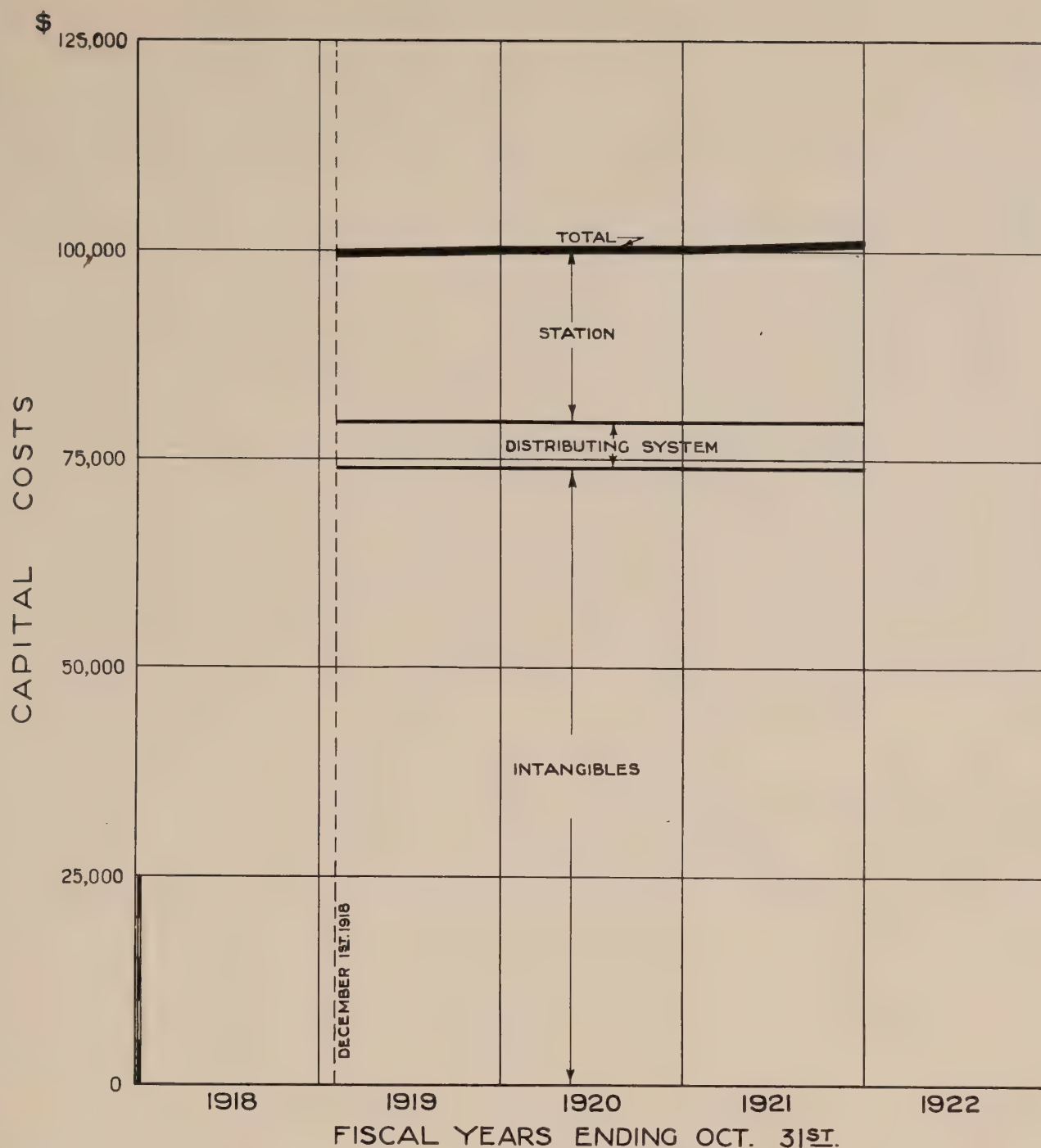
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Country	1911	1912	Total	
			1911	1912
United States	1,000,000	1,000,000	2,000,000	2,000,000
Canada	100,000	100,000	200,000	200,000
Great Britain	1,000,000	1,000,000	2,000,000	2,000,000
France	1,000,000	1,000,000	2,000,000	2,000,000
Germany	1,000,000	1,000,000	2,000,000	2,000,000
Italy	1,000,000	1,000,000	2,000,000	2,000,000
Japan	1,000,000	1,000,000	2,000,000	2,000,000
China	1,000,000	1,000,000	2,000,000	2,000,000
India	1,000,000	1,000,000	2,000,000	2,000,000
Australia	1,000,000	1,000,000	2,000,000	2,000,000

Walter J. Fanck & Company

The following table shows the effect of the various factors on the total production of the United States in the year 1911. The table is divided into two parts, the first of which contains the data for the year 1911, and the second contains the data for the year 1912. The data for the year 1911 is given in the first column, and the data for the year 1912 is given in the second column. The data for the year 1911 is given in the first column, and the data for the year 1912 is given in the second column.





**HYDRO-ELECTRIC INQUIRY COMMISSION**  
**W. D. GREGORY, CHAIRMAN**

**ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS**

**THOROLD SYSTEM**

**PROGRESSIVE CAPITAL COSTS**

Toronto, June 5th., 1923. Made by *WJF* Checked by *WJF*

**WALTER J. FRANCIS & COMPANY**  
 CONSULTING ENGINEERS



Table of Horse-power Developed, Consumed, Billed, Etc.

	Fiscal Year Ending October 31st,			
	1919	1920	1921	1922
H.P. Purchased	963	1,116	2,083	1,591
H.P. Average Consumed	578	724	1,090	846
H.P. Billed to Consumer	524	769	2,228	1,816
H.P. Average of Monthly Peaks (a)	911	1,280	2,149	1,470
H.P. Maximum Yearly Peak (b)	1,370	2,268	2,568	2,968

(a) corrected for power factor.

(b) not corrected for power factor.

It will be noted that there are five classes of horse-power shown in the table and in the diagrams. These may be explained as follows:

Purchased Horse-power.

The figures for purchased horse-power were obtained from the records of the Hydro-Electric Power Commission and represent all power purchased from the Ontario Power Company in each of the years from 1919 to 1922.

Average Horse-power Consumed by the System.

The average horse-power consumed by the System has been derived from the total number of kilowatt-hours stated by the Hydro-Electric Power Commission as being the total supply to the Thorold System for the four years ending October 31st, 1919, 1920, 1921 and 1922. The derivation was made by dividing the total kilowatt-hours per fiscal year by the number of hours in each period and reducing to horse-power by dividing by the factor, 0.746.

HORSE-POWER DATA



Table 10. Comparison between the two models.

	1961	1962	1963	1964	1965
U.S. National Income	1,000	1,000	1,000	1,000	1,000
U.S. National Income (a)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (b)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (c)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (d)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (e)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (f)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (g)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (h)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (i)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (j)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (k)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (l)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (m)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (n)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (o)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (p)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (q)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (r)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (s)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (t)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (u)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (v)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (w)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (x)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (y)	1,000	1,000	1,000	1,000	1,000
U.S. National Income (z)	1,000	1,000	1,000	1,000	1,000

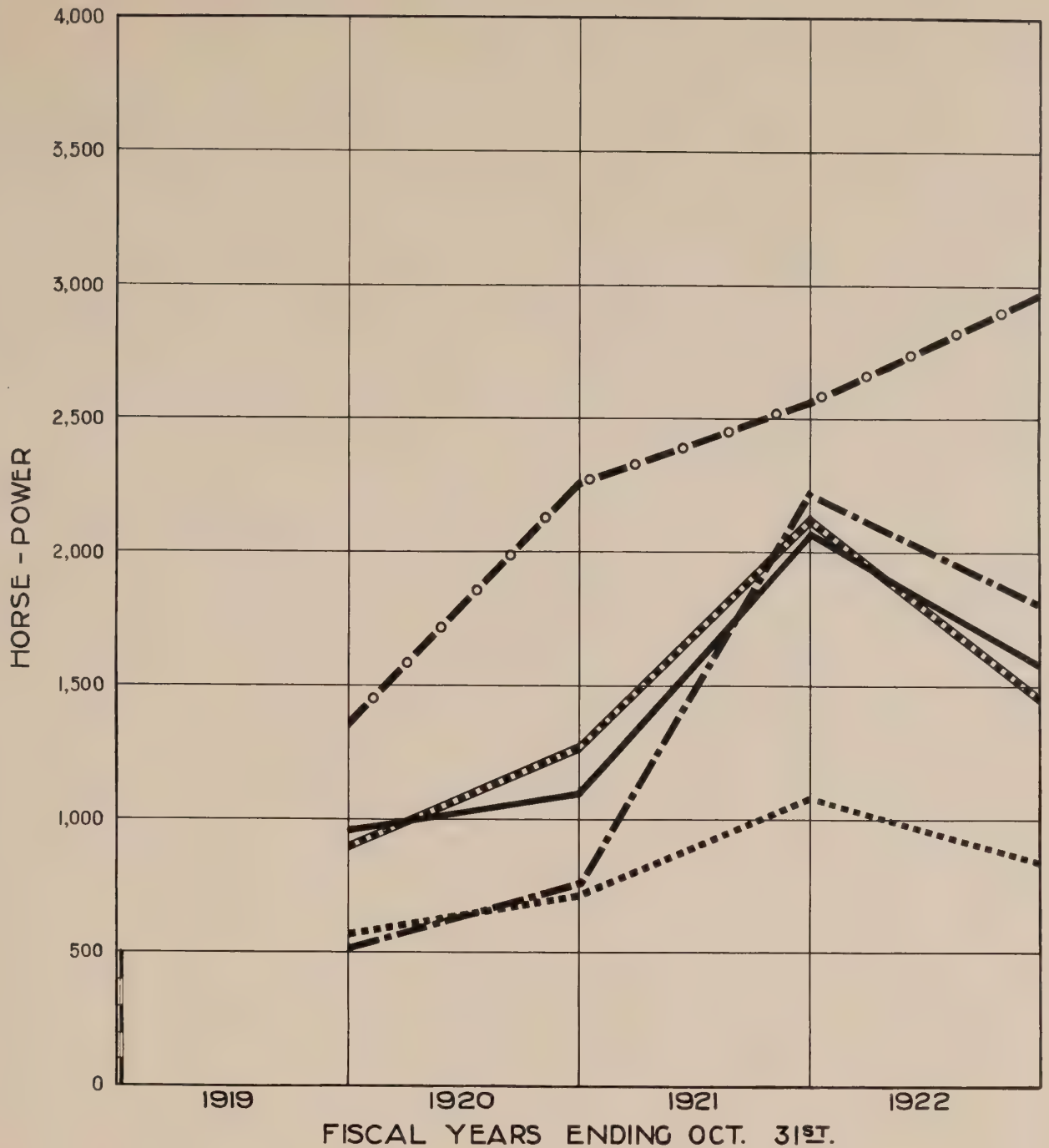
COPIES OF THE REPORTS OF THE

— *Journal of the American Medical Association*, 1997

Ontario Power Company in each of the years from 1919 to 1922.

— 2012.01.15 11:11:00 —

The average income per person of the United States has been estimated by the Bureau of Economic Analysis at \$1,100. The average income per person of the United States has been estimated by the Bureau of Economic Analysis at \$1,100.



H. P. PURCHASED  
 H. P. AVERAGE CONSUMED  
 H. P. BILLED TO CONSUMER  
 H. P. AVERAGE OF MONTHLY PEAKS  
 H. P. MAXIMUM YEARLY PEAK

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HYDRO-ELECTRIC INQUIRY COMMISSION  
 W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

THOROLD SYSTEM

**HORSE-POWER DATA**

Toronto, June 5th., 1923. Made by *WJF* Checked by *WJF*

WALTER J. FRANCIS & COMPANY  
 CONSULTING ENGINEERS





Billed Horse-power.

The figures for billed horse-power were obtained from the records of the Hydro-Electric Power Commission, and where power had been billed on a kilowatt-hour basis, as was the case in a few instances, the number of kilowatt-hours was converted to the equivalent average horse-power in the manner described under the heading of "Average Horse-power Consumed by the System".

Average Monthly Peaks.

COPY  
The figures for the average monthly peak horse-power were obtained by taking the sum of the monthly peaks as shown by the records of the Hydro-Electric Power Commission, and dividing by twelve to get a yearly average monthly peak. The figures for the fiscal year of 1919, which contained only eleven months, have been derived in a similar way using eleven instead of twelve.

Maximum Yearly Peak.

The figures for the maximum yearly peak horse-power were obtained from the records of the Hydro-Electric Power Commission and represent the maximum load on the System at any time throughout the year.

The curves on page 18 are the diagrammatic representation of the table of horse-power.

Capital Costs per Horse-power Purchased.

The following table and the sheet of curves included as page 21 indicate

THE LICENSEE'S OBLIGATIONS

The license for the licensee's use of the licensee's name and other marks shall be subject to the licensee's obligation to pay to the licensor a fee of \$1.00 per copy of the license. The license shall be subject to the licensee's obligation to pay to the licensor a fee of \$1.00 per copy of the license. The license shall be subject to the licensee's obligation to pay to the licensor a fee of \$1.00 per copy of the license.

THE LICENSEE'S OBLIGATIONS

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the fractional capital costs per horse-power purchased for the years 1919 to 1921 inclusive, based on the figures showing the total capital costs of the System and the horse-power data given previously. The sheet of curves therefore indicates the capital costs per horse-power purchased, with spaces between adjacent curves indicating that portion of the total capital per horse-power chargeable against each of the items of the table.

Table of Capital Costs per Horse-power Purchased

	1919	1920	1921
Transformer Station	\$ 21.40	\$ 18.90	\$ 10.40
Distributing System	5.00	5.00	2.70
Intangibles	77.00	66.50	35.60
Totals	\$104.20	\$ 90.40	\$ 48.70

As there is no power locally generated on the Thorold System, no capital costs for generating stations are shown in the table. The figures for transformer station cover the single station at Thorold with its equipment which has a capacity of about 2,000 K.V.A. In 1921 the power purchased was practically the full capacity of the station, so that the capital cost of the transformer station per horse-power purchased will probably not fall below the figure for that year, namely \$10.40.

The distributing system is small and lines are short, making the capital costs per horse-power purchased very low.

The capital cost of "intangibles" per horse-power purchased, which represents the franchises, royalties, and contracts taken over from Mr. James Battle,

CAPITAL COSTS  
PER H.P. PURCHASED



1964

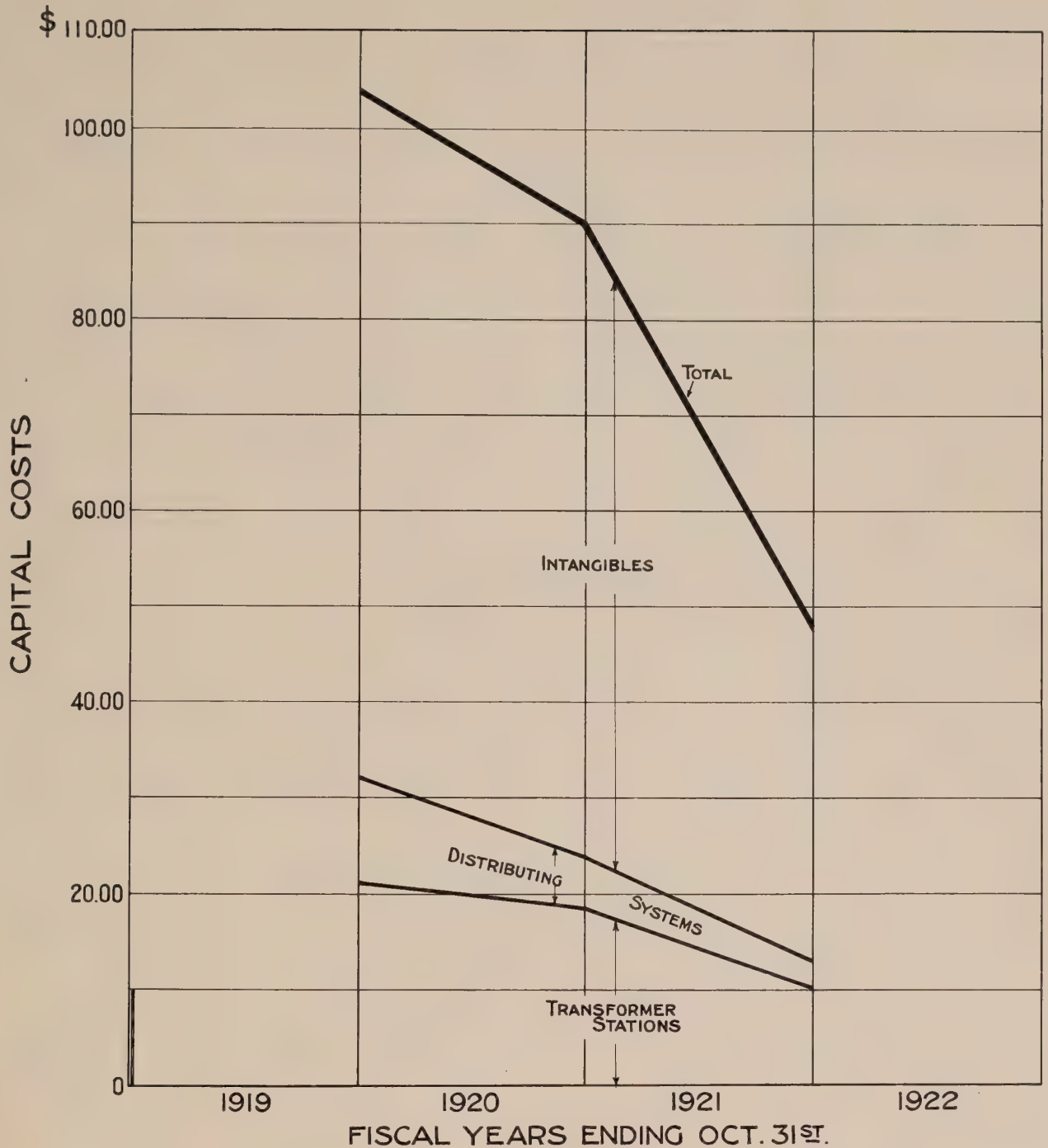
The following table shows the estimated costs of the various items of the investment, based on the latest available data. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power.

Table of Capital Costs per Horse-power Purchased

Item	Cost	Item	Cost
Interest	\$ 1.00	Interest	\$ 1.00
Depreciation	8.40	Depreciation	8.40
Operating	1.00	Operating	1.00
Total	\$ 10.40	Total	\$ 10.40

The following table shows the estimated costs of the various items of the investment, based on the latest available data. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power.

The following table shows the estimated costs of the various items of the investment, based on the latest available data. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power. The cost of the investment is estimated to be \$10.40 per horse-power.



HYDRO-ELECTRIC INQUIRY COMMISSION  
W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

**THOROLD SYSTEM  
CAPITAL COSTS  
PER H.P. PURCHASED**

Toronto, June 5th., 1923. Made by *gob.*, Checked by *W.F.*

WALTER J. FRANCIS & COMPANY  
CONSULTING ENGINEERS





\$100,000

is high; but these rights have up to the present been very profitable to the System.

If it should be desired to obtain the capital costs per horse-power installed, that is per horse-power of the capacity of the transformers of the transforming station, the total capital costs for each year may be divided by 2,145, which is the approximate installed capacity of the transformer station expressed in electrical horse-power.

#### Total Annual Revenues.

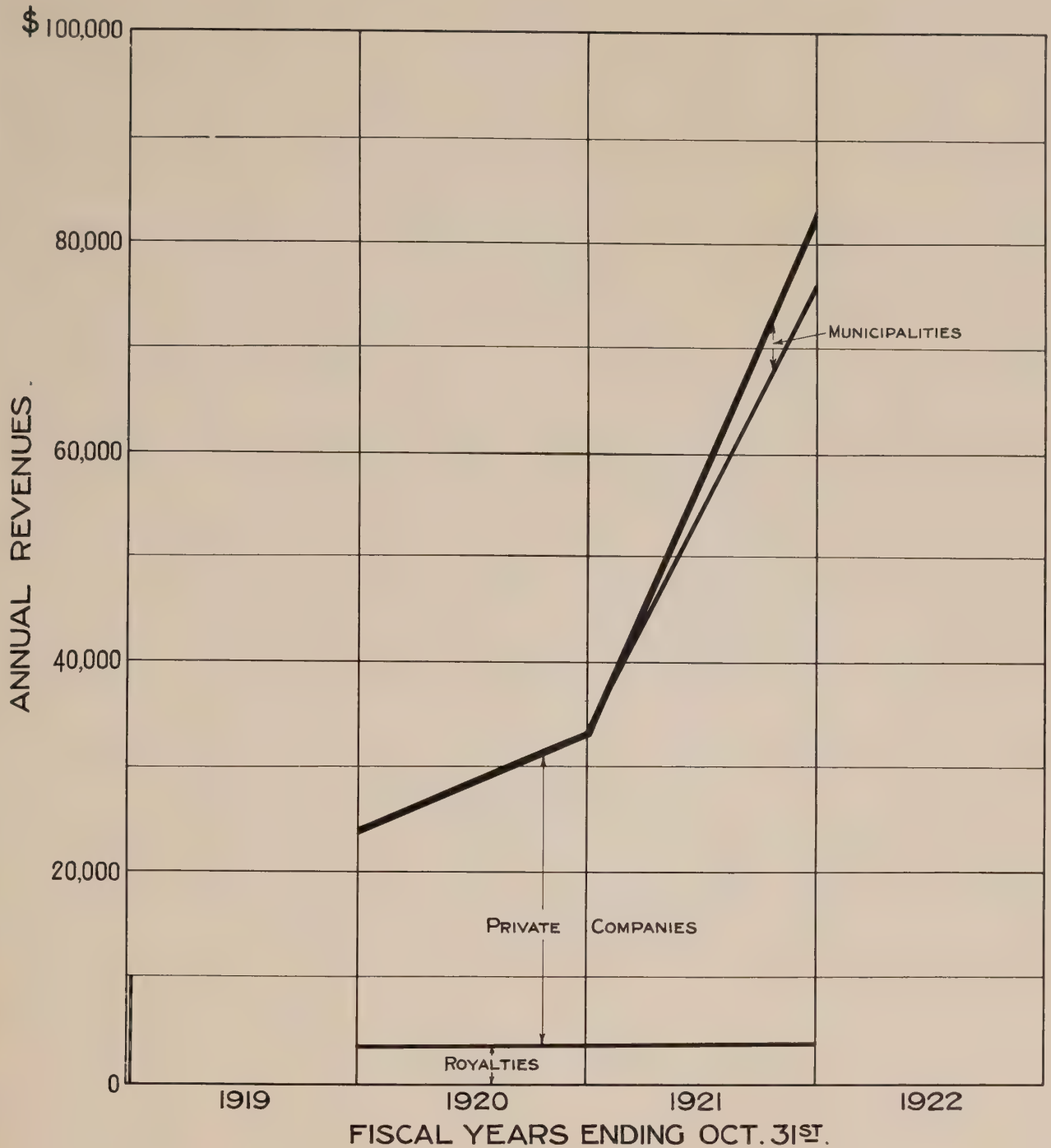
The following table and the sheet of curves included as page 23, giving the total revenues of the Thorold System, have been prepared by using the figures given in the report of Messrs. Price, Waterhouse & Co., already mentioned, for the years 1919 to 1921 inclusive. The figures are as follows:

Table of Total Annual Revenues

	11 Months Ending Oct. 31st, 1919	Fiscal Year Ending Oct. 31st, 1920	Oct. 31st, 1921
From Royalties (Ontario Power Co.)	\$ 3,502	\$ 3,511	\$ 3,775
From Private Companies	20,581	29,806	72,292
From Municipalities	-	-	6,963
<b>Totals</b>	<b>\$24,083</b>	<b>\$33,317</b>	<b>\$83,050</b>

The large increase in revenues from private companies in 1921 over the preceding year is to be noted. This is very largely due to power sold to Messrs. Doheny, Quinlan & Robertson for use on their contract on the construction of the Welland Ship Canal. Their bill for power that year amounted to





HYDRO-ELECTRIC INQUIRY COMMISSION  
W. D. GREGORY, CHAIRMAN  
ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS  
**THOROLD SYSTEM**  
**TOTAL ANNUAL REVENUES**  
Toronto, June 5th, 1923. Made by *ggb*, Checked by *L.H.*  
**WALTER J. FRANCIS & COMPANY**  
CONSULTING ENGINEERS





\$62,498, whereas in 1922 it amounted to about \$36,000. In 1922, P. Lyall & Sons, who were also doing construction work on the Canal, bought power to the value of about \$65,000. The sale of power to these customers must be considered as a temporary source of revenue which will probably last for only three or four years longer.

Deducting the revenue from these two consumers in the years 1921 and 1922, there has been a decrease in revenues from the remainder of the private companies. These revenues amounted to \$24,053 for eleven months in 1918, and only about \$17,500 in 1922.

The Town of Thorold, which commenced to take power in 1921, is the only municipality supplied and there are no rural lines on the System.

#### Total Annual Costs of Power.

The table on page 26 shows the cost of power subdivided under various headings for each of the years from 1919 to 1921 inclusive, the fiscal year ending October 31st, 1919, containing eleven months only. The sheet of curves included as page 27 shows these figures plotted in graphic form.

The headings under which the various costs have been grouped are as follows:

#### Power Purchased.

A separate heading for power purchased has been included for the reason that there is no power generated on this System by the Commission and the power purchased is the largest single item of the annual costs of power. The power

(12)

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purchased by the System from the Ontario Power Company is paid for at the rate specified in the agreements dated October 14th, 1910, and April 29th, 1912,

between James Battle and the Ontario Power Company, which were acquired by the capital invested in the System. The individual items for power for the year ended December 31st, 1918, have been combined.

1918, these rates are \$13.00 and \$13.50 per horse-power per annum depending on the area in which it is used. For the power taken in excess of the quantity specified in the contract a tentative charge of \$17.00 per horse-power has been made, this figure being based on an invoice from the Ontario Power Company to James Battle in which, in addition to the \$13.00 and the \$13.50 rate, a rate of \$17.00 is shown. The account may require adjustment at a later date when the rate for this excess power will have been definitely fixed.

#### Operating Costs.

Reserves for Sinking Fund

Operating costs include the wages of the station attendants, linemen and so forth, supplies and all the miscellaneous items usually grouped under this heading. This item also contains a portion of the overhead and general expense, and these various charges have been combined in one total in the report of Messrs. Price, Waterhouse & Co.

#### Maintenance.

The individual items covered by this heading have been combined by Messrs. Price, Waterhouse & Co. with a portion of the administrative and general expense items, and the total only is shown in their report.

[illegible]

1. The first part of the document is a list of names and titles, including "The Hon. Mr. Justice" and "The Hon. Mr. Justice".

of Messrs. Price, Waterhouse & Co.

The following items covered by this heading have been combined by Messrs.



Interest, Renewals, Sinking Fund, Surplus.

The figures for interest include all interest charges shown for the capital invested in the System. The individual items for each of these headings have been combined by Messrs. Price, Waterhouse & Co. into a single total for each, the figures in the table for these charges having been taken directly from the Price, Waterhouse & Co. report.

Table of Total Annual Costs of Power

	11 Months Ending Oct. 31st, 1919	Fiscal Year Ending October 31st, 1920	1921
Power Purchased	\$11,692	\$15,406	\$31,720
Operation	1,778	1,409	659
Maintenance	62	582	302
Interest	3,671	3,859	3,518
Reserve for Renewals	830	933	952
Reserve for Sinking Fund	1,758	1,918	1,932
Total Cost	\$19,691	\$24,107	\$39,083
Surplus from Sale of Power	890	5,699	40,192
from Royalties	3,502	3,511	3,775
Total Revenues	\$24,083	\$33,317	\$83,050

It is to be noted that the Commission owns and operates the Thorold System at its own risk and that a very large proportion of its revenues comes from private companies. This has enabled it to operate at a profit every year and have a very substantial surplus as a result of each year's operations.

Percentage Costs of Power.

The following table and the sheet of curves included as page 28 show the

HYDRO-ELECTRIC INQUIRY COMMISSION  
W. D. GREGORY, CHAIRMAN

TOTAL ANNUAL COSTS



1914-1915 1916-1917 1918-1919 1920-1921 1922-1923

from the Price, Esterhuysen & Co. report.

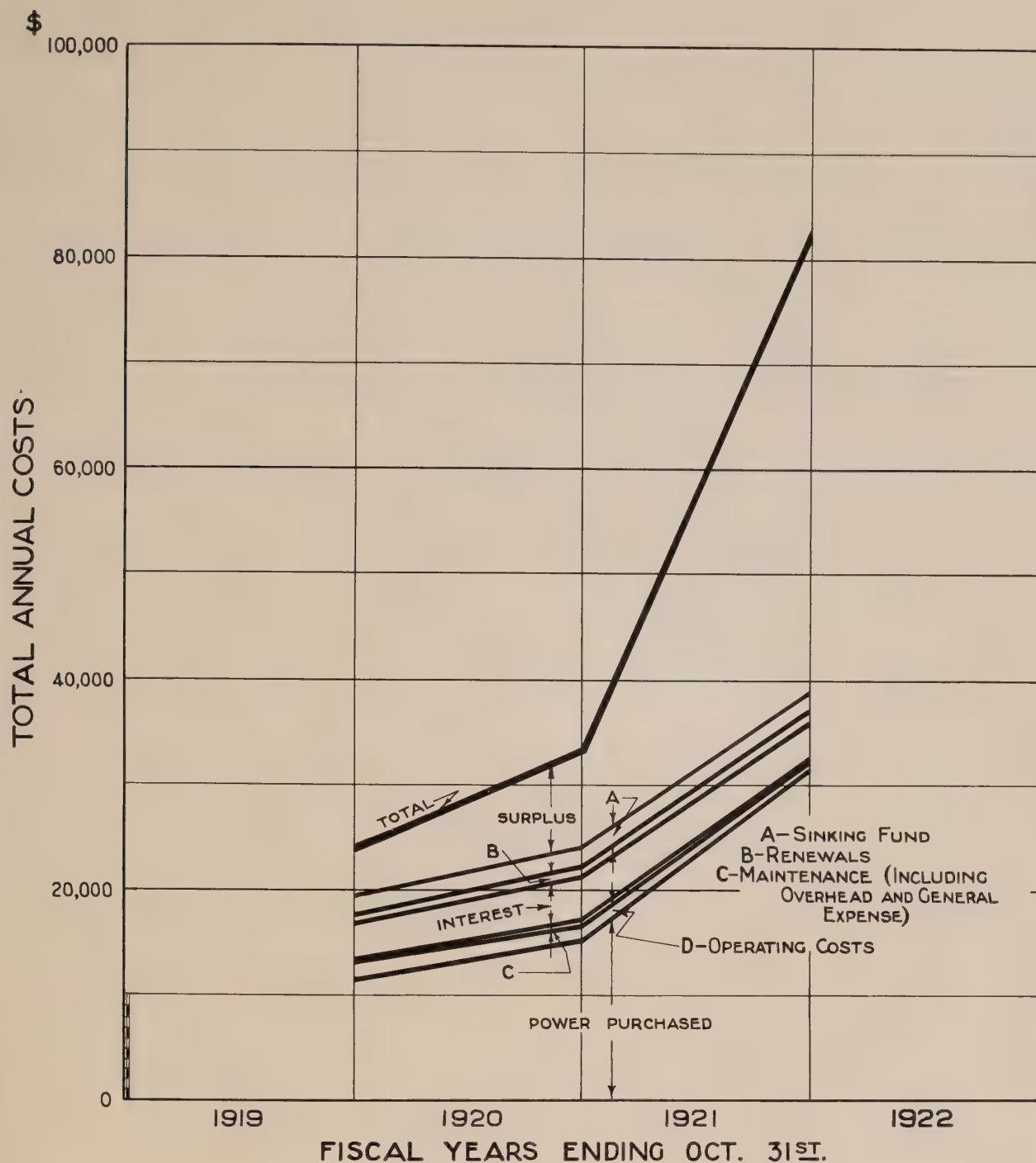
1.994 to 1.997 1.997 to 1.999

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It is to be noted that the Commission never had operated the Special Agent at the New York and that a very large majority of its members were from private companies. This has resulted in its operating in a purely private way and not a very substantial manner as a result of such poor organization.

1. *Phragmites australis* (Cav.) Trin. ex Steud.

The following table lists the names of the persons who have been admitted to the bar since the last report of the Board of Bar Examiners.



Note:

Total Surplus Was Appropriated for Sinking Fund Reserve at the End of 1921

**HYDRO-ELECTRIC INQUIRY COMMISSION**  
W. D. GREGORY, CHAIRMAN

**ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS**

**THOROLD SYSTEM**

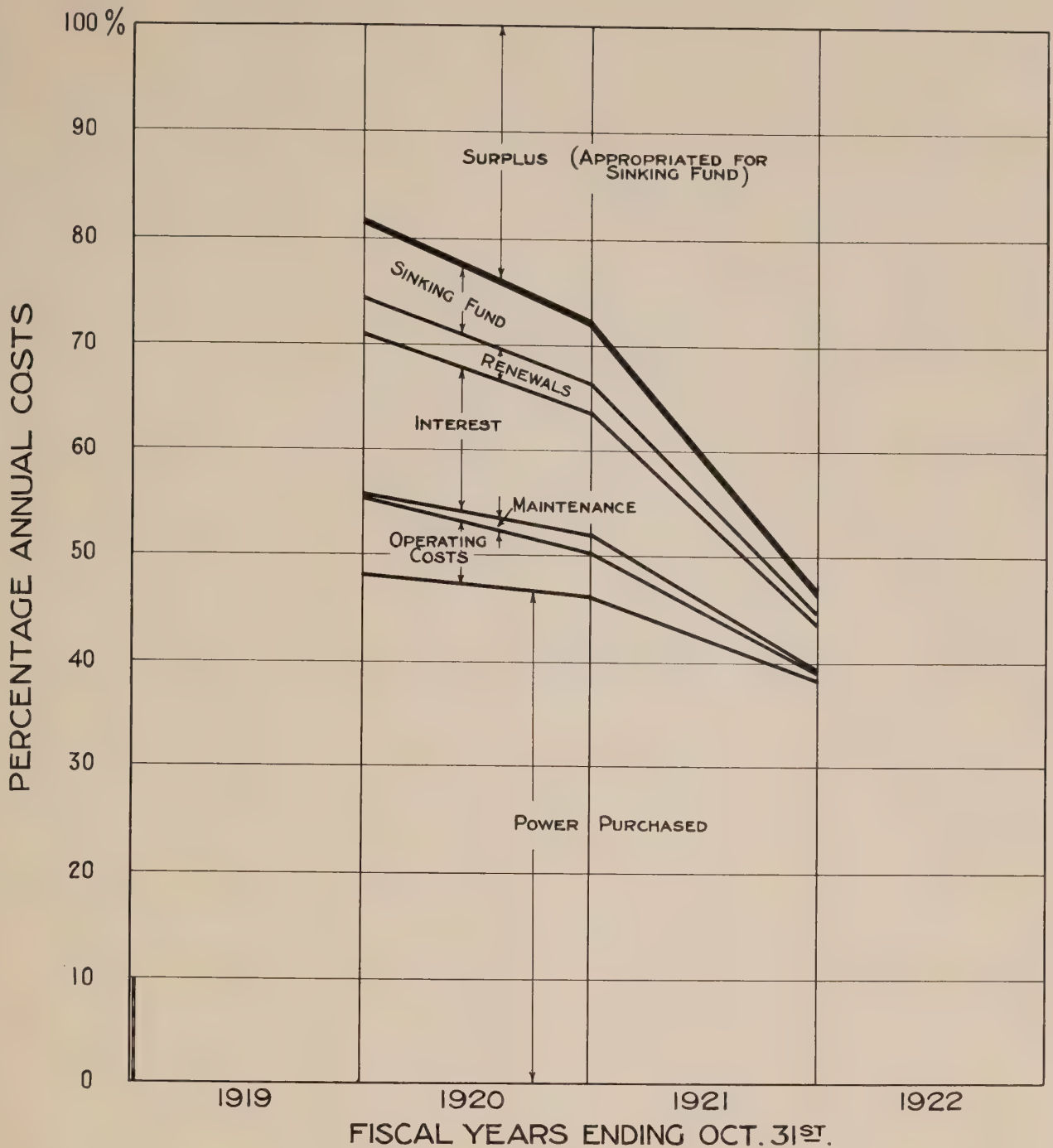
**TOTAL ANNUAL COSTS**

Toronto, June 5th., 1923. Made by *WJF* Checked by *WJF*

**WALTER J. FRANCIS & COMPANY**  
CONSULTING ENGINEERS







HYDRO-ELECTRIC INQUIRY COMMISSION  
W. D. GREGORY, CHAIRMAN  
ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS  
**THOROLD SYSTEM**  
**ANNUAL COSTS SUBDIVIDED**  
**BY PERCENTAGES**

Toronto, June 5th., 1923. Made by *gdb.* Checked by *L.H.*

WALTER J. FRANCIS & COMPANY  
CONSULTING ENGINEERS



annual cost figures as percentages of the total costs of power per annum, and these are included as a method of comparison with other systems or similar properties.

Table of Annual Costs Subdivided by Percentages

Fiscal Period Ending October 31st,			
	1919	1920	1921
Power Purchased	48.2	46.2	38.2
Operation	7.4	4.2	.8
Maintenance	.3	1.7	.4
Interest	15.2	11.6	4.2
Reserve for Renewals	3.4	2.8	1.1
Reserve for Sinking Fund	7.3	5.8	2.3
Surplus	18.2	27.7	53.0
Total	107.0%	100.0%	100.0%

#### Analysis of Reserve Accounts.

##### Renewals Account.

The renewals account set up for the Thorold System is on a 3.5 per cent. sinking fund basis, following the usual sinking fund method for providing a fund for equipment deteriorating in use. The useful life in years of each portion of the depreciable capital invested, the replacement cost, and the residual or scrap value of the articles at the end of this time are all estimated and an amount is set aside which, when compounded at an assumed earning rate, will retire the total amount to be provided for at the end of the estimated useful life. It is understood that it is the practice of the Hydro-Electric



Annual cost figures are percentages of the total costs of power for 1920, and these are included in a table of comparison with other systems in this report.

Table of Annual Costs Subdivided by Percentages

Financial Results During Operating Year			
1921	1920	1919	
2.1	2.5	2.2	Power Expenses
8.	4.2	7.4	Operation
4.	1.7	3.	Maintenance
4.2	11.6	12.2	Interest
1.1	2.8	2.4	Reserve for Renewals
2.3	2.8	7.3	Reserve for Sinking Fund
22.2	27.2	28.2	Totals
100.0	100.0	100.0	Total

# ANALYSIS OF POWER EXPENSES

## POWER EXPENSES

The power expense per unit of the electrical system is an important factor in determining the cost of electricity. The power expense is determined by the cost of the fuel, the cost of the labor, and the cost of the maintenance. The power expense is also determined by the efficiency of the system, the capacity of the system, and the age of the system. The power expense is also determined by the cost of the interest on the capital invested in the system, and the cost of the depreciation of the capital. The power expense is also determined by the cost of the taxes on the system, and the cost of the insurance on the system. The power expense is also determined by the cost of the other expenses of the system, such as the cost of the office, the cost of the telephone, and the cost of the other services. The power expense is also determined by the cost of the other factors which affect the cost of electricity, such as the cost of the fuel, the cost of the labor, and the cost of the maintenance.

Power Commission to spend sufficient money on maintenance account each year to keep each and every portion of the System in a condition to operate in accordance with the requirements of economical production, which it is stated is considered to be about 75 per cent. as good as its original new condition. This being so, it was considered in this report that the renewal account should be studied in connection with and applied to the renewal of only 25 per cent. of the capital concerned. It is shown on page 25 of this report that the reserve

The following table shows the amounts of the reserves for renewals account for each of the years from 1918 to 1921 inclusive, the addition each year to the reserve having been made at the rate of 3.5 per cent. of the capital invested in tangible property.

The estimated useful life of the System may be considered to be somewhat less than half over, as it was largely built about 1912; and considering the reserve for renewals in relation to 25 per cent. of the depreciable capital investments which will have to be renewed from this fund at the end of its useful life, it is apparent that the reserve is sufficient. If the rate of 3.5 per cent. is continued and no charges made against this reserve, the amount to the credit of the reserve for renewals will in three years more exceed 25 per cent. of the depreciable capital. It would therefore appear that the percentage rate used in determining the amount to be set aside yearly for the reserve for renewals might with propriety be reduced without impairing the sufficiency of the reserve.

The Commission is of the opinion that the proposed plan is a sound one and that it is in the best interests of the Government to approve it. It is recommended that the plan be approved and that the necessary steps be taken to carry it out.

the official documents.

The Commission is of the opinion that the proposed plan is a sound one and that it is in the best interests of the Government to approve it. It is recommended that the plan be approved and that the necessary steps be taken to carry it out.

COPY

The Commission is of the opinion that the proposed plan is a sound one and that it is in the best interests of the Government to approve it. It is recommended that the plan be approved and that the necessary steps be taken to carry it out.



Table of Reserve for Renewals

Date	Total Amount of Accumulated Reserves
October 31st, 1919, (11 months)	\$ 830
October 31st, 1920	1,796
October 31st, 1921	2,820

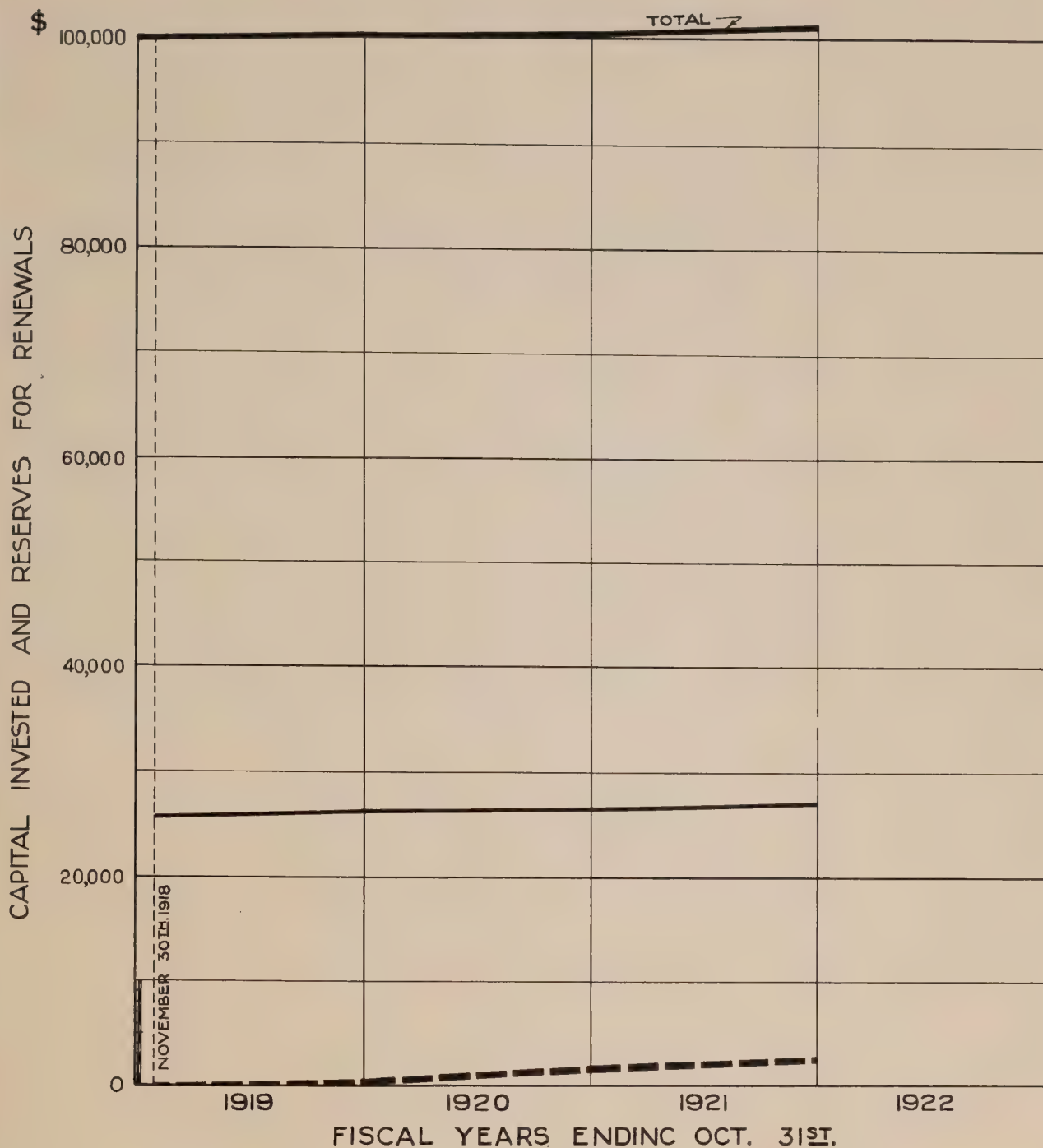
The sheet of curves included as page 32 of this report shows the reserve for renewals in graphic form in its relation to the total capital costs and to the approximate depreciable capital costs. The depreciable capital costs here shown do not include any of the intangible capital costs, though the actual value of "intangibles" is rapidly depreciating. This is however taken care of by the "sinking fund reserve" and will be referred to later.

Sinking Fund Reserves.

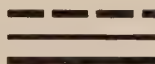
Under the agreement of October 1st, 1918, relative to the purchase of the Thorold System, no mention is made of a sinking fund to retire the bonds given as the purchase price of the System. The Commission has, however, each year included in the cost of operation a charge to provide a sinking fund reserve for the retirement of the bonds of the System. The basis of this charge is 2.56 per cent. (24-year basis) on \$57,500, the present worth of the royalties at the date of purchase of the System when their remaining life amounted to 24 years, and 1.05 per cent. (40-year basis) on the balance of \$42,500 of bonds.

APPROXIMATE DEPRECIABLE CAPITAL COSTS HYDRO-ELECTRIC INQUIRY COMMISSION  
The sinking fund reserve thus provided from operations amounted to about \$5,829 at October 31st, 1921. At that date it was decided to transfer the whole surplus amounting to about \$57,569 to the sinking fund reserves, which thus became





RESERVE FOR RENEWALS  
 APPROXIMATE DEPRECIABLE CAPITAL COSTS  
 TOTAL CAPITAL COSTS



HYDRO-ELECTRIC INQUIRY COMMISSION  
 W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

THOROLD SYSTEM

**RESERVES FOR RENEWALS**

Toronto, June 5th., 1923. Made by *WJF* Checked by *WJF*

WALTER J. FRANCIS & COMPANY  
 CONSULTING ENGINEERS





about \$63,398. As no part of the funds set aside for the sinking fund reserves has been paid to the Commission for that purpose, the Commission has not been required to invest these funds in securities of the Province of Ontario, but holds them in its general funds as a credit to the Thorold System; part of this surplus is the result of the construction of the Bellard

A standard form of contract relative to the supply of power is, however, in force between the Commission and the Town of Thorold which now takes power from this System, and in a few years that municipality will have to make payments to the Commission for sinking fund purposes which will alter the present status of this fund.

It is worthy of note that the amount at present in the sinking fund reserve would, if compounded at four per cent. per annum and if no additions were made to it, exceed by over fifty per cent. the amount required to retire the bonds at their maturity on December 1st, 1958.

The sinking fund reserves for fiscal years ending October 31st were as follows:

1919	-	\$ 1,758
1920	-	3,747
1921	-	63,398

#### Reserve for Contingencies.

No reserve for contingencies has as yet been established, and while the value of the station and distributing system is small, it would seem to be good policy to establish such a fund to meet any emergencies which might arise.

costs given in the table on page 16 by the curves for the variable charges of power given in the table on page 17. The curves for the fixed charges of

about 1945, 1946, as an part of the funds not made for the electric power system has been paid to the Commission for that purpose, the Commission has not been required to invest these funds in securities of the electric system, but rather than in the general funds as a credit to the electric system.

A standard cost of contract relating to the supply of power is, however, in force between the Commission and the four of electric utility companies from this system, and in a few years that commission will have to make payments to the Commission for electric power and equipment which will also be made to the electric system.

status of this fund.

It is worthy of note that the fund is present in the electric system. It is composed of four per cent. per annum and is an addition to the funds of the electric system. The fund is not required to be used for the bonds at their maturity on December 1st, 1956.

The electric fund reserves for electric power system are as follows:

1945	-	\$ 1.75
1946	-	2.747
1947	-	23.358

Electric Power System.

As shown the Commission has an electric power system, and since the value of the electric and electric power is small it would seem to be more likely to be sold to the electric power system than to the electric system.



Discussion of Deficits and Surpluses.

The Thorold System is owned outright by the Commission and operated by it at its own risk. The operation has resulted in a substantial surplus each year. A large part of this surplus is the result of the construction of the Welland Ship Canal and the high price for power charged to Messrs. Doherty, Quinlan & Robertson, one of the contractors on the works. It is understood that an adjustment of this high rate has been made during 1922 and the reduced rate made retroactive.

It is apparent that the System will operate at a substantial profit even after the assistance derived from the sale of power to the Welland Ship Canal contractors will have been withdrawn.

Revenues and Costs per Horse-power per Annum.

In order to reduce the total costs of operation to a basis on which these could be compared with other systems, a set of tables and diagrams has been prepared to show the costs per horse-power per annum for different bases of horse-power. The figures have also been analyzed to show the total annual costs subdivided into fractional amounts chargeable against the items of expense, based on the horse-power purchased per annum.

The table on page 36 and the sheet of curves included as page 35 of this report show the total cost per horse-power per annum on different bases. The figures in the table were obtained by dividing the figures for total annual costs given in the table on page 26 by the figures for the various classes of horse-power given in the table on page 17. The curves show the figures of the

REMARKS OF THE COMMISSIONER OF THE GENERAL LAND OFFICE

The Commission is now engaged in the study of the problem of the land in the State of New York. The Commission has received a large number of suggestions from the public, and it is now in the process of selecting a committee to study the problem. The Commission has also received a large number of suggestions from the public, and it is now in the process of selecting a committee to study the problem. The Commission has also received a large number of suggestions from the public, and it is now in the process of selecting a committee to study the problem.

REMARKS OF THE COMMISSIONER OF THE GENERAL LAND OFFICE

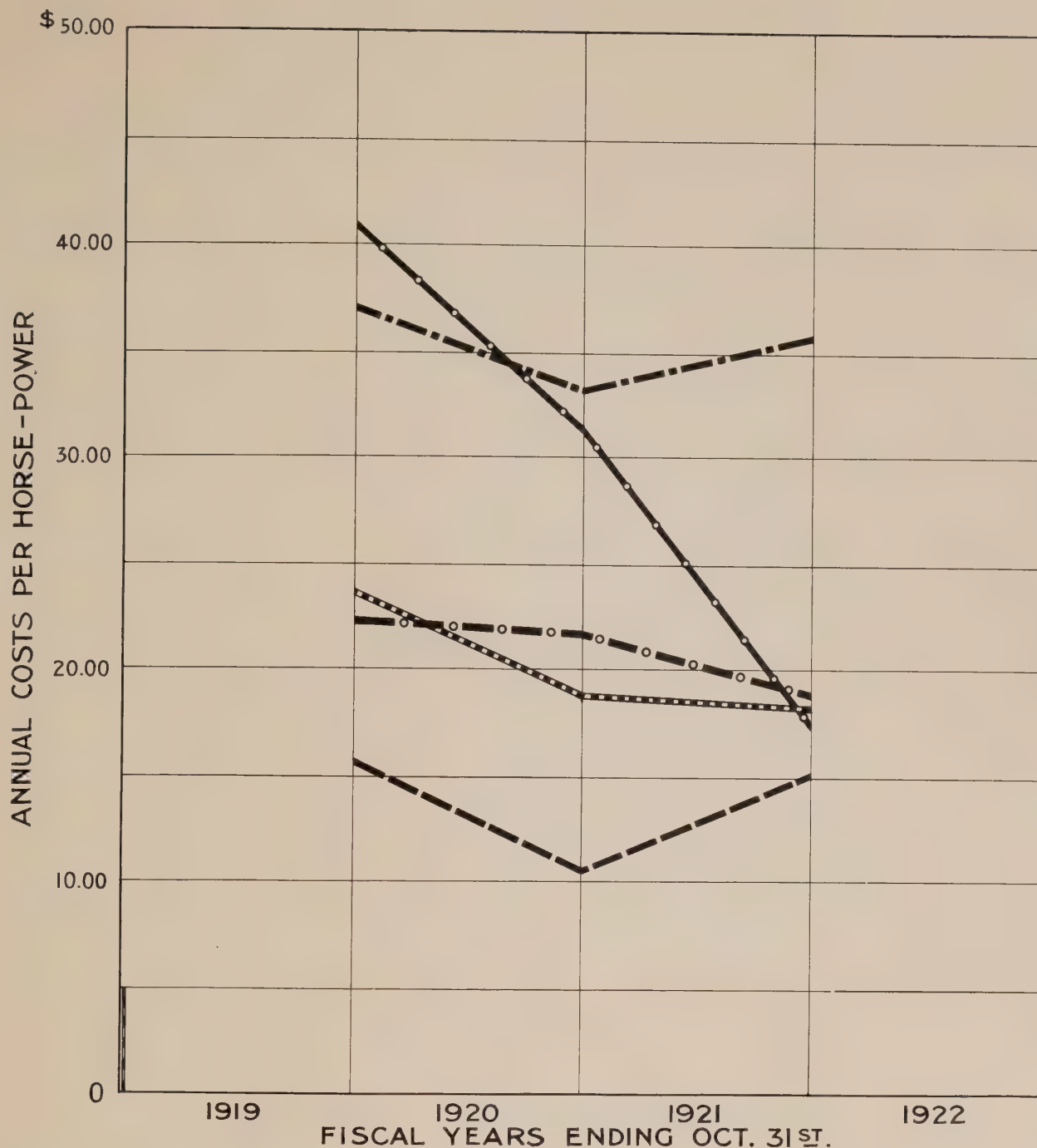
It is suggested that the Commission will study the problem of the land in the State of New York. The Commission has also received a large number of suggestions from the public, and it is now in the process of selecting a committee to study the problem. The Commission has also received a large number of suggestions from the public, and it is now in the process of selecting a committee to study the problem.

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H. P. PURCHASED  
 H. P. CONSUMED BY SYSTEM  
 H. P. BILLED TO CONSUMERS  
 H. P., AVERAGE 12 MONTHLY PEAKS  
 H. P., MAXIMUM YEARLY PEAK



HYDRO-ELECTRIC INQUIRY COMMISSION  
 W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

**THOROLD SYSTEM  
 COSTS PER H.P. PER ANNUM  
 VARIOUS H.P. BASES**

Toronto, June 5th., 1923. Made by SRW, Checked by L.J.F.

WALTER J. FRANCIS & COMPANY  
 CONSULTING ENGINEERS





table diagrammatically.

A table on page 37 shows the cost per annum per horse-power purchased subdivided into the various items, power purchased, operation, maintenance, interest, reserve for renewals, reserve for sinking fund. It also shows the surplus and revenues per annum per horse-power purchased. The curves on page 38 show these figures graphically.

Another table on page 37 shows the subdivided cost under the same headings, the surplus and the revenue per annum per average horse-power consumed by the system. In other words, they represent the cost per horse-power on a basis of 100 per cent. load factor. These figures are shown graphically by the curves on page 38.

The last table on page 37 shows the subdivided cost under the same headings, the surplus and the revenue per annum per horse-power billed to consumers on the system. These figures are shown graphically by the curves on page 38.

It is to be noted that the revenues per horse-power billed to consumers do not represent the average cost per horse-power to the consumer, as the royalties derived from the power sold to the Ontario Paper Company by the Ontario Power Company, amounting to about \$3,600 per year, are included in the total revenue and add very materially to the surplus.

Table of Total Costs per Horse-power per Annum

	1919 on Annual Basis	1920	1921
H. P. Purchased	\$22.31	\$21.60	\$18.76
H. P. Consumed by System	37.17	33.30	35.86
H. P. Billed to Consumers	41.00	31.35	17.54
H. P. Average of Monthly Peaks	23.57	18.63	19.19
H. P. Maximum Yearly Peak	15.69	10.63	15.22





Table of Subdivided Costs per Horse-power Purchased

	1919 on Annual Basis	1920	1921
Power Purchased	\$ 13.13	\$ 13.80	\$ 15.22
Operating Costs	2.02	1.28	.32
Maintenance	.07	.52	.14
Interest	4.15	3.48	1.69
Reserve for Renewals	.94	.84	.46
Reserve for Sinking Fund	2.00	1.72	.93
Total Cost to System	\$ 22.31	\$ 21.60	\$ 18.76
Surplus from Sale of Power	1.01	5.10	19.30
Surplus from Royalties	3.96	3.15	1.81
Total Revenues	\$ 27.28	\$ 29.85	\$ 39.87

Table of Subdivided Costs per Average Horse-power Consumed by System

Power Purchased	\$ 21.87	\$ 21.28	\$ 29.10
Operating Costs	3.36	1.95	.60
Maintenance	.12	.60	.28
Interest	6.94	5.33	3.24
Reserve for Renewals	1.57	1.29	.87
Reserve for Sinking Fund	3.31	2.65	1.77
Total Cost to System	\$ 37.17	\$ 33.30	\$ 35.86
Surplus from Sale of Power	1.68	7.88	36.83
Surplus from Royalties	6.61	4.84	3.46
Total Revenues	\$ 45.46	\$ 46.02	\$ 76.20

Table of Subdivided Costs per Horse-power Billed to Consumers

Power Purchased	\$ 24.13	\$ 20.03	\$ 14.23
Operating Costs	3.71	1.83	.30
Maintenance	.13	.76	.14
Interest	7.66	5.02	1.58
Reserve for Renewals	1.72	1.21	.43
Reserve for Sinking Fund	3.65	2.50	.86
Total Cost to System	\$ 41.00	\$ 31.35	\$ 17.54
Surplus from Sale of Power	1.85	7.42	18.03
Surplus from Royalties	7.29	4.56	1.70
Total Revenues	\$ 50.14	\$ 43.23	\$ 37.27

(10)

Statement of Assets and Liabilities of the Corporation

1911	1910	1909
Fixed Assets	\$ 1,000.00	\$ 1,000.00
Operating Assets	1.00	1.00
Reserves	1.00	1.00
Interest	2.00	2.00
Reserve for Depreciation	1.00	1.00
Reserve for Working Fund	1.00	1.00
Total Assets	\$ 1,006.00	\$ 1,006.00
Liabilities	1.00	1.00
Capital	\$ 1,000.00	\$ 1,000.00
Total Liabilities	\$ 1,006.00	\$ 1,006.00

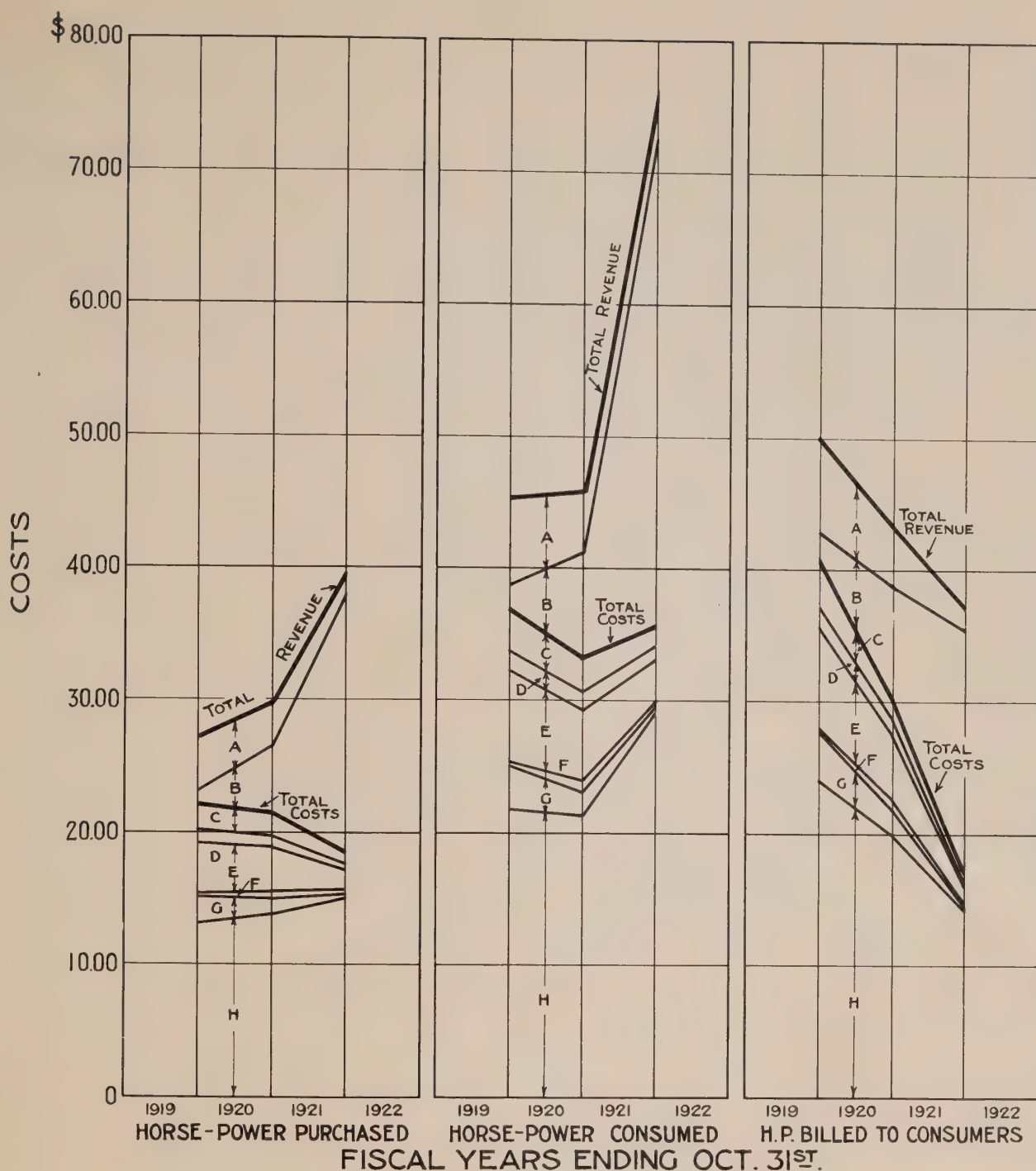
Statement of Income and Expenses of the Corporation

COPY

Power Purchased	\$ 21.87	\$ 21.88	\$ 20.10
Operating Costs	2.30	1.90	1.80
Reserves	1.00	1.00	1.00
Interest	2.00	2.00	2.00
Reserve for Depreciation	1.00	1.00	1.00
Reserve for Working Fund	1.00	1.00	1.00
Total Cost to System	\$ 29.17	\$ 29.68	\$ 27.90
Surplus from Sale of Power	1.00	1.00	1.00
Surplus from Operations	1.00	1.00	1.00
Total Surplus	\$ 2.00	\$ 2.00	\$ 2.00

Statement of Assets and Liabilities of the Corporation

Fixed Assets	\$ 1,000.00	\$ 1,000.00	\$ 1,000.00
Operating Assets	1.00	1.00	1.00
Reserves	1.00	1.00	1.00
Interest	2.00	2.00	2.00
Reserve for Depreciation	1.00	1.00	1.00
Reserve for Working Fund	1.00	1.00	1.00
Total Assets	\$ 1,006.00	\$ 1,006.00	\$ 1,006.00
Liabilities	1.00	1.00	1.00
Capital	\$ 1,000.00	\$ 1,000.00	\$ 1,000.00
Total Liabilities	\$ 1,006.00	\$ 1,006.00	\$ 1,006.00



A-SURPLUS FROM ROYALTIES  
 B-SURPLUS FROM SALE OF POWER  
 C-RESERVE FOR SINKING FUND  
 D-RESERVE FOR RENEWALS  
 E-INTEREST  
 F-MAINTENANCE  
 G-OPERATING COSTS  
 H-POWER PURCHASED

**HYDRO-ELECTRIC INQUIRY COMMISSION**  
 W. D. GREGORY, CHAIRMAN  
 ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS  
**THOROLD SYSTEM**  
**SUBDIVIDED COSTS PER H.P. PER ANNUM**  
**VARIOUS H. P. BASES**  
 Toronto, June 5th., 1923. Made by *W.F.*, Checked by *L.H.*  
**WALTER J. FRANCIS & COMPANY**  
 CONSULTING ENGINEERS





Kilowatt-hour Data and Annual Revenues and Costs per Kilowatt-hour.

The only kilowatt-hour figures available give the totals consumed by the System, and these are not divided into the quantities taken by the various classes of consumers. The cost and the revenue per kilowatt-hour are shown in the following table and these figures are shown graphically on the curves on page 40.

Table of Kilowatt-hour Data

	1919	1920	1921
Costs per Kilowatt-hour	\$ 0.0057	\$ 0.0051	\$ 0.0055
* Revenue per Kilowatt-hour	0.0059	0.0063	0.0111

\* This does not include the revenues from royalties for power sold to the Ontario Paper Company by the Ontario Power Company.

Taking the sum of the number of companies buying power direct from the System and the number of customers buying from the Town of Thorold, the total number of consumers supplied by the System was 1,100 in 1921. The figures for other years are not available. The table below shows the kilowatt-hours per consumer and per head of population in that year.

Kilowatt-hours per Consumer in 1921 6,476  
Kilowatt-hours per capita of population in 1921 1,290.

COSTS PER KWH.  
REVENUE PER KWH.

Summary.

A summary of a number of the more salient points which have been studied

COSTS AND REVENUES  
PER KWH

1931

### Statement of Assets and Liabilities of the Company

The following statement shows the assets and liabilities of the Company as at the end of the year 1931. The assets are shown on the left and the liabilities on the right. The total assets are equal to the total liabilities, as shown in the following table:

Page 40.

Table of Assets and Liabilities

1931	1930	1929
Assets	Assets	Assets
0.0113	0.0088	0.0088
0.0113	0.0088	0.0088

This table shows the assets and liabilities of the Company as at the end of the year 1931. The total assets are equal to the total liabilities, as shown in the following table:

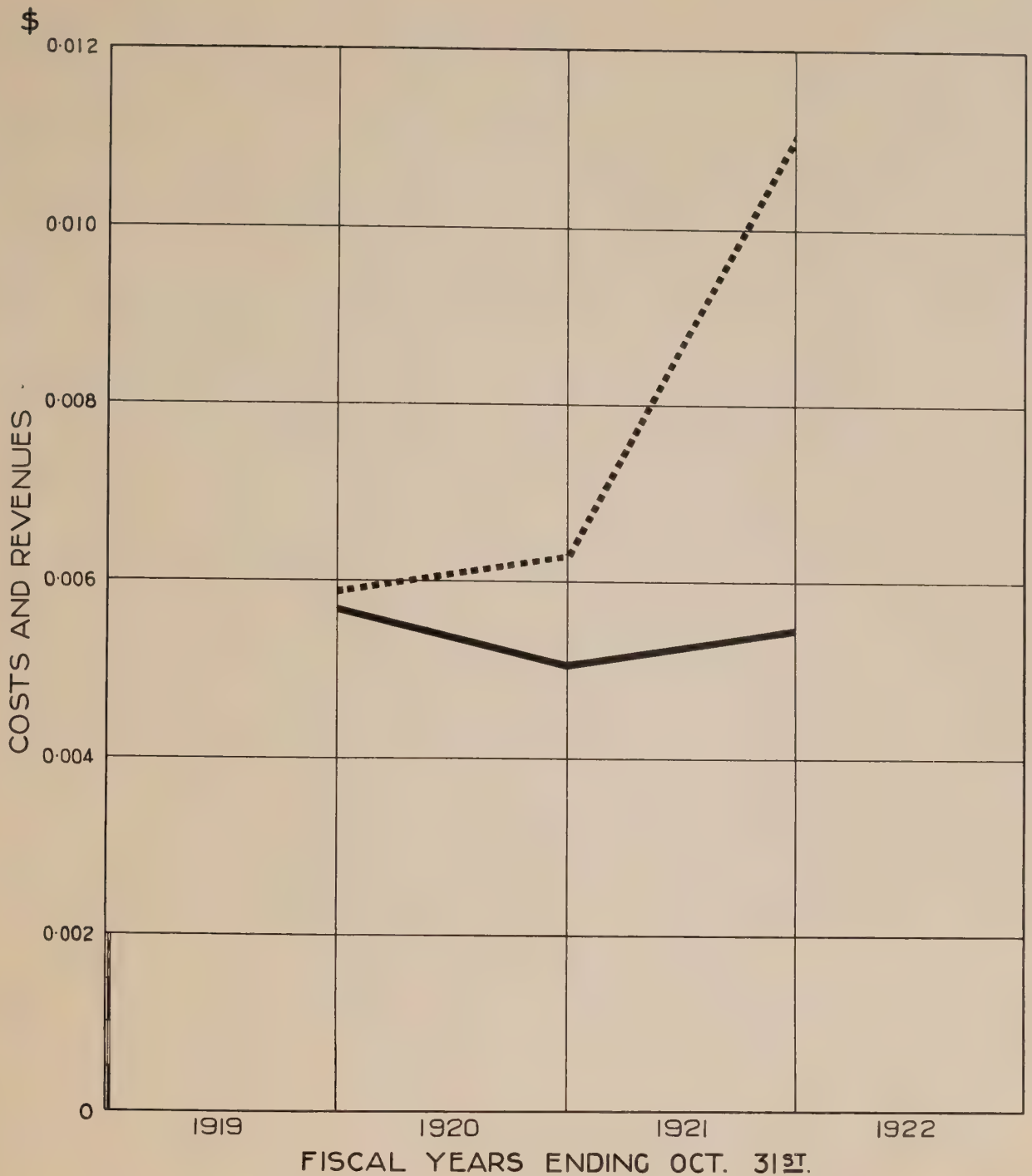
During the year 1931 the sum of the assets of the Company was \$1,000.00. The sum of the liabilities of the Company was \$1,000.00. The sum of the assets of the Company was equal to the sum of the liabilities of the Company, as shown in the following table:

Assets per share of \$1.00 in 1931  
Liabilities per share of \$1.00 in 1931

Assets

A summary of the assets of the Company as at the end of the year 1931 is given in the following table:





COSTS PER K.W.H.  
REVENUE PER K.W.H.



HYDRO-ELECTRIC INQUIRY COMMISSION  
W. D. GREGORY, CHAIRMAN

ECONOMICS OF H. E. P. C. DISTRIBUTION SYSTEMS

**THOROLD SYSTEM  
COSTS AND REVENUES  
PER K.W.H.**

Toronto, June 5th, 1923. Made by *WJF*, Checked by *WJF*

WALTER J. FRANCIS & COMPANY  
CONSULTING ENGINEERS



and discussed in the foregoing report may be of advantage in continuing the consideration of the economics of the Thorold System. They are as follows:

- (1) The capital costs of the Thorold System contain nothing for generating plants, but the "intangibles" are valued at a large figure for the size of the system. The surplus which has been earned each year is very largely due to the franchises and rights covered by these intangible capital costs; and its size is an indication that they are proving of much greater value than their cost, in four years having enabled a surplus and reserve to be set aside of sufficient size to about equal their original cost.
- (2) The market for power is well covered, and, although much of the load is of a temporary nature due to the construction of the Welland Ship Canal, it is reasonable to assume that the more permanent type of load will continue to increase in a satisfactory manner.
- (3) Power is not sold to companies "at cost", but on contract at a definite price which does not include any sinking fund charge, so that these consumers are not acquiring an equity in the System. The Town of Thorold, however, is buying power "at cost", though the figure charged at present is tentative. The sinking fund charge is deferred until 1926; therefore up to the present no outside interest has any equity in the System.
- (4) The reserves and surpluses being more than sufficient to retire, at their maturity, the bonds given in payment for intangible capital assets, it would seem advisable to reorganize the finances of the System and eliminate intangibles and the necessary sinking fund to retire them; and then join the Thorold System to the Niagara System if there are no legal difficulties in the way of such procedure.
- (5) The audited balance sheet and operating account for the fiscal year 1922 are not yet available and the figures have therefore not been included in this report.

*Walter J. Francis*

Consulting Engineer.

Toronto, June 5th, 1923.

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